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NATIONAL DAM INSPECTION REPORT. LAKE ONDAWA DAM (NDI ID NUMBER --ETC(U)
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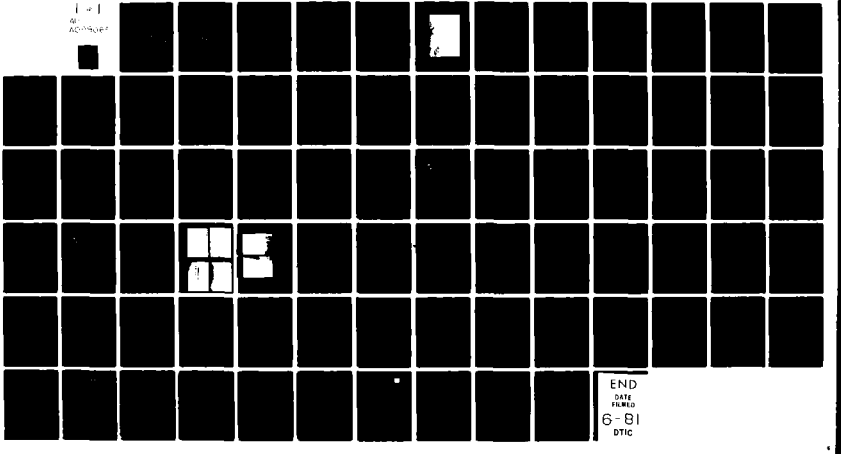

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SUSQUEHANNA RIVER BASIN
TRIBUTARY BENTLEY CREEK, BRADFORD COUNTY

PENNSYLVANIA

LAKE ONDAWA DAM

NDI ID NO. PA-517
DER ID NO. 8-28

TIM LEONARD ROD AND GUN CLUB

Prepared By
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

DACW31-81-C-0012

FOR
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

APRIL, 1981

SUSQUEHANNA RIVER BASIN

TRIBUTARY BENTLEY CREEK, BRADFORD COUNTY

PENNSYLVANIA

(6 National Dam Inspection Report.

LAKE ONDAWA DAM

(NDI ID Number PA-517

DER ID Number 8-28)

~~TIM LEONARD ROD AND GUN CLUB~~

Susquehanna River Basin, Tributary Bentley Creek, Bradford County, Pennsylvania. Phase I Inspection Report,

(10 Jeffrey R. Hill

(12) 78

Prepared By

L. ROBERT KIMBALL & ASSOCIATES

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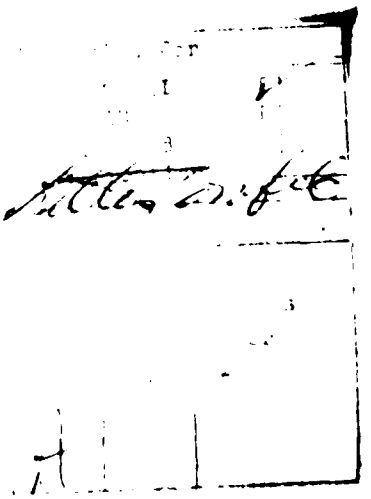
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Lake Ondawa Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Bradford
STREAM	Tributary to Bentley Creek
DATE OF INSPECTION	October 22, 1980 and January 15, 1981
COORDINATES	Lat: 41° 53.1' Long: 76° 42.5'

ASSESSMENT

The assessment of Lake Ondawa Dam is based upon visual observations made at the time of inspection, review of available records and data, hydraulic and hydrologic computations and past operational performance.

The Lake Ondawa Dam appears to be in fair condition and adequately maintained. The recently repaired spillway approach wingwalls and control section retaining walls indicate on-going maintenance at the structure. The concrete spillway channel appeared to be in fair condition. No major deficiencies were observed which would affect the discharge potential of the structure. No seepage was observed on the downstream face of the dam or along the toe of the structure. An erosion area was observed along the right edge of the spillway overflow section. Maintenance of the operating facilities is considered poor. The flip gate on the 6 inch drainline is not operated.

The Lake Ondawa Dam is a high hazard-small size dam. The recommended spillway design flood (SDF) for a dam of this size and classification is in the range of 1/2 PMF to PMF. Based on the downstream potential for loss of life, the Spillway Design Flood has been selected as the PMF. The spillway and reservoir are capable of controlling less than 10% of the PMF without overtopping the embankment. Based on criteria established by the Corps of Engineers, the spillway is termed seriously inadequate. The Lake Ondawa Dam is classified as an unsafe, non-emergency structure.

The following recommendations and remedial measures should be instituted immediately.

1. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction to increase the spillway capacity.

2. It should be ascertained whether the upstream flip valve on the 6 inch cast iron pipe drainline is capable of operation. If the flip gate is operable, it should be operated on a regular basis to

insure it functions for its intended use. If the upstream flip gate is not operable, it should be made operable or other provisions should be made for upstream closure of the pipe through the embankment.

3. The erosion observed along the right edge of the downstream face of the vertical masonry wall should be repaired as soon as possible.

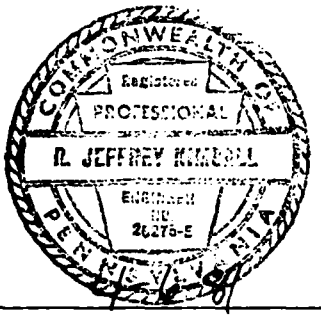
4. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

5. A regularly scheduled operations and maintenance program should be prepared and implemented to insure the continued safe operation of the structure.

6. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel. Particular attention should be paid to the condition of the masonry and its ability to support the earth embankment and any seepage that may develop.

SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS



Date

R. Jeffrey Kimball, P.E.

APPROVED BY:

21 APR 81

Date

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Overview of Lake Ondawa Dam.

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APPENDICES

PHASE I
NATIONAL DAM INSPECTION PROGRAM

LAKE ONDAWA DAM
NDI. I.D. NO. PA 517
DER I.D. NO. 8-28

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. The Lake Ondawa Dam is an earthfill dam, 50 feet long and 18 feet high. The crest width of the dam is approximately 28 feet. The upstream slope of the dam on either side of the spillway is approximately 2H:1V. The earthen embankment section is grass covered and no riprap exists on the upstream slope. The downstream slope of the dam consists of a near vertical masonry wall. A concrete corewall exists in the embankment.

The spillway for the Lake Ondawa Dam is located near the middle of the earthen embankment section and constitutes at least half of the embankment length. The spillway is rectangular shaped with a reinforced concrete crest. The broad crested control section is 21.6 feet wide and 23 feet long. The side walls for the spillway crest consist of concrete retaining walls and a masonry wall which supports a foot bridge that spans the spillway crest.

b. Location. The dam is located on a tributary to Bentley Creek, approximately 0.3 mile northwest of the Village of Big Pond, Springfield Township, Bradford County, Pennsylvania. The Lake Ondawa Dam can be located on the Bentley Creek, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. The Lake Ondawa Dam is a small size dam (18 feet high, 215 acre-feet).

d. Hazard Classification. Lake Ondawa Dam is a high hazard dam. Downstream conditions indicate that the loss of more than a few lives and property damage is probable should the structure fail. The Village of Big Pond is located approximately 0.3 mile southeast of the dam.

e. Ownership. The Lake Ondawa Dam is owned by the Tim Leonard Rod & Gun Club, Inc. Correspondence should be addressed to:

Mr. Thomas Calkins, III, President
Tim Leonard Rod & Gun Club, Inc.
510 Elmira Street
Troy, PA 16947
717/297-2115

f. Purpose of Dam. The dam was constructed for recreational purposes.

g. Design and Construction History. Based on information available in the PennDER files, it appears as though Lake Ondawa is a natural lake. Sometime prior to 1919 the original owner of the dam raised the pool level to operate a saw mill. No information was available regarding the operation of the saw mill. In 1910, the owner, at that time, attempted to breach the dam in order to turn the surrounding area into farmland. While breaching the dam, the owner hit bedrock and was unable to totally drain the reservoir. It was reported that approximately 15 acres of reservoir area remained after the attempted breach.

On September 23, 1929, an application was made to restore the structure. After application requirements were completed, reconstruction of the structure began in late 1929. Based on available information, it appears as though the dam was designed by Mr. Charles Leonard. The construction of the dam was completed in mid December, 1929, and the construction of the dam was completed by club members.

The original design of the dam (See Appendix E-2 and E-3) called for a masonry wall across the full length of the dam. The length of the dam was to be 50 feet. The spillway crest was to be 24 feet wide and 11 feet long. The spillway crest was to be constructed of reinforced concrete along the entire length of the spillway. The downstream face of the wall was to be near vertical and of masonry construction. The depth of the spillway was to be 3 feet. The core of the dam was constructed of earthfill. A 12 inch conrete corewall was constructed along the entire length of the dam. A 6 inch blowoff pipe was constructed through the embankment. At the upstream end of the 6 inch blowoff pipe a concrete structure was constructed with a flip gate to control discharge through the pipe.

Information contained in the September 19, 1920 application indicate that the original dam had been overtopped at times; but there had not been damage to the structure.

h. Normal Operating Procedures. No operations are presently conducted at the dam. The reservoir level is maintained at the spillway crest elevation.

1.3 Pertinent Data.

a. Drainage Area. 1.03 square miles

b. Discharge at Dam Site (cfs).

Maximum flood at dam site	Unknown
Drainline capacity at normal pool	Less than 10
Spillway capacity at top of dam	255
Spillway capacity (Design)	324

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on an assumed spillway crest elevation, 1568.0 from U.S.G.S. quadrangle.

Top of dam - low point	1570.5
Top of dam - design height	Unknown
Pool at time of inspection	1567.7
Spillway crest (assumed)	1568.0
Maximum pool - design surcharge	Unknown
Normal pool	1568.0
Upstream invert - 6" drainline	Unknown
Downstream invert - 6" drainline	1553.4
Maximum tailwater	Unknown
Toe of dam	1552.4

d. Reservoir (feet).

Length of maximum pool	2700
Length of normal pool	2500

e. Storage (acre-feet).

Normal pool (spillway crest)	153
Top of dam	215

f. Reservoir Surface (acres).

Top of dam	26
Normal pool	23
Spillway crest	23

g. Dam.

Type	Earthfill
Length (including spillway)	50 feet
Height	18 feet
Top width	28 feet
Side slopes - upstream	2H:1V
- downstream	Vertical

Zoning	None
Impervious core	12" concrete corewall
Cutoff	Yes
Grout curtain	None

h. Reservoir Drain.

Type	6" cast iron pipe
Length	Approximately 52 feet
Closure	Flip gate on upstream end
Access	Presently, none
Regulating facilities	Flip gate

i. Spillway.

Type	Broad crest
Length (crest)	21.6 feet
Crest elevation	1568.0
Upstream channel	Lake (unrestricted)
Downstream channel	Bentley Creek

SECTION 2
ENGINEERING DATA

2.1 Design. Review of available information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources, revealed that some correspondence, permit information, pictures and several design drawings were available for review. Mr. Thomas Calkins, Sr. and Mr. Theodore W. Calkins, Jr., accompanied the inspection team during the inspection. Both men are members of the Tim Leonard Rod & Gun Club, but neither member was able to provide any additional information.

2.2 Construction. No information exists regarding the construction of the dam other than the work was completed by members of the Tim Leonard Rod & Gun Club.

2.3 Operation. No operations are conducted at the dam.

2.4 Evaluation.

a. Availability. Engineering data were provided by PennDER, Bureau of Dams and Waterway Management. Two members of the Tim Leonard Rod & Gun Club were interviewed to obtain data relative to the maintenance of the dam.

b. Adequacy. This Phase I Report is based on the visual inspection and hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Lake Ondawa Dam was conducted by personnel of L. Robert Kimball and Associates on October 22, 1980 and January 15, 1981. Mr. Thomas Calkins, Sr., and Mr. Theodore Calkins, Jr. accompanied the inspection team during the October 22, 1980 inspection. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appeared to be in fair condition. From a brief survey conducted during the inspection, it was noted that the low spot on the top of dam existed adjacent to either edge of the spillway on the retaining walls. The earthen embankment section rises gently from the spillway to either abutment.

It was observed that the spillway approach wingwalls and the walls of the spillway control section had recently been repaired. No cracks were observed on the spillway crest or adjacent retaining walls. The downstream face of the dam was observed to be a near vertical masonry wall. The masonry appeared to be in fair condition. A small erosion area was observed along the right edge of the masonry wall. The downstream face of the dam serves as the overflow section for the spillway. The 6" drainline outlet was observed at the base of the masonry wall. No flow was observed discharging from the pipe. No seepage was observed on the masonry wall or along the toe of the wall.

c. Appurtenant Structures. The spillway for the dam exists at mid-embankment. The concrete wingwalls were recently repaired and the concrete appeared to be in good condition. A minor amount of brush and debris was observed in the discharge channel for the spillway. The spillway crest appeared to be in good condition.

It was reported by members of the Tim Leonard Rod & Gun Club that the drainline had not been operated for many years. Neither member of the club who accompanied the inspection team had ever seen the drainline valve operated.

d. Reservoir Area. The watershed for the Lake Ondawa Dam is covered almost entirely with forested land. The reservoir slopes are relatively steep immediately adjacent to the reservoir. The reservoir slopes did not appear to be susceptible to landslides which would affect the storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel for the Lake Ondawa Dam consists of Bentley Creek. The downstream channel is relatively narrow for a distance of approximately 0.3 mile, at which point discharges from Bentley Creek flow through Big Pond. Several homes (10 people) are located immediately adjacent to Bentley Creek at the outlet of the downstream channel for Lake Ondawa.

3.2 Evaluation. In general, the dam and appurtenant structures appeared to be in fair condition. It was reported by members of the Tim Leonard Rod & Gun Club, who accompanied the inspection team, that repairs were made recently to the concrete approach and retaining walls for the spillway. The drainline flip gate has not been operated in many years. The operation of the flip gate should be evaluated.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The normal operating procedure at the lake is to maintain the reservoir at the spillway crest elevation. The 6" drainline has not been operated in many years. Neither member of the Rod & Gun Club who accompanied the inspection team had ever remembered the drainline being operated.

4.2 Maintenance of the Dam. No planned maintenance schedule exists for the dam. Maintenance of the dam is performed by club members on an unscheduled, as-needed basis. Recent maintenance at the dam has consisted of the reconstruction of concrete approach and spillway retaining walls.

4.3 Maintenance of Operating Facilities. No maintenance of the operating facilities are conducted at the dam. No known date is associated with the last operation of the spillway drainline flip gate.

4.4 Warning System in Effect. There is no warning system in effect to warn downstream residents of large spillway discharges or imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam is considered fair, and maintenance of the operating facilities is considered poor. No known date is associated with the last operation of the drainline flip gate.

An emergency action plan should be available for every dam in the high and significant category. Such plans should outline actions to be taken by the operator to minimize downstream affects of an emergency and should include an effective warning system. No emergency action plan has been developed, and the owner should develop such a plan.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. Limited information relative to the hydraulic and hydrologic design were available. Information contained in the DER files suggests that the spillway was designed to have a crest length of 24 feet and a depth of 3 feet, which was considered as having a discharge capacity of 324 cubic feet per second. Information in the files suggest that the design capacity was sufficient to provide for over 50% of the maximum expected flood.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway reportedly has functioned adequately in the past.

c. Visual Observations. The spillway appeared to be in fair condition and adequately maintained. Minor amounts of brush and debris were observed in the spillway discharge channel.

The low spot on the embankment crest was observed to exist adjacent to either spillway retaining wall. The spillway is a rectangular shaped structure. The control section was assumed to exhibit the properties of a broad crested weir.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. Pool elevation in the reservoir prior to the storm is at the spillway crest elevation, 1568.0.

2. The top of dam was considered the low spot elevation, 1570.5.

3. The spillway crest was assumed to be a constant elevation along its entire length.

4. The effect of the foot bridge which spans the spillway crest was neglected in the analysis.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	4840 cfs
Spillway capacity	255 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) is based on the hazard and size classification of the dam. The recommended spillway design flood for a dam of this size and classification is in the range of 1/2 PMF to PMF. Based on the potential for loss of life, the spillway design flood has been selected as the PMF. Based on the following definition provided by the Corps of Engineers, the spillway is rated as seriously inadequate as a result of our hydrologic and hydraulic analysis.

> Seriously inadequate - All high hazard dams not capable of passing 50% of the spillway design flood (PMF) and where there is a significant increase in the downstream hazard potential for loss of life due to dam failure.

The spillway and reservoir are capable of controlling approximately 10% of the PMF without overtopping the embankment.

5.4 Summary of Dam Breach Analysis. As the subject dam cannot satisfactorily pass 50% of the PMF (based on our analysis) it was necessary to perform the dam breach analysis and downstream routing of the flood wave. This analysis determined the degree of increased flooding due to dam failure. It was the judgement of the evaluating engineer that the dam was capable of sustaining a limited overtopping. The 3.45 feet of overtopping associated with the 1/2 PMF event was considered sufficient to cause failure of the structure due to the depth of flow and the duration of overtopping. A pool elevation of 1573.5 feet was considered sufficient to cause failure of the dam due to overtopping. An overtopping depth of 3.0 feet was considered in our analysis.

The results of the dam breach analysis indicate that the downstream potential for loss of life and property damage is significantly increased from that which existed prior to failure. Three homes located along the stream would be damaged due to the flood wave associated with the simulated dam failure. Therefore, the spillway is rated as seriously inadequate. The dam is classified as an unsafe, non-emergency structure. Details of the downstream routing of the flood wave are included in Appendix D.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. No visible deficiencies were observed during the inspection which denoted the need for emergency action. No erosion was observed on the embankment crest. No major erosion or seepage were observed on the downstream face of the dam or along the toe. No movement or misalignment suggesting settlement of the dam was observed.

The spillway appeared to be in fair condition and adequately maintained. No cracks were observed in the spillway channel. The approach wingwalls and channel retaining walls had recently been repaired. The downstream masonry face of the dam (spillway overflow section) appeared to be in fair condition. A small erosion channel was observed along the right edge of the wall.

b. Design and Construction Data. Limited information relative to the original design of the dam was available in the DER files. Two drawings relative to the original design appear in Appendix E. No construction data was available for review. It was noted in the DER correspondence file that the construction of the dam was completed by members of the Tim Leonard Rod & Gun Club.

c. Operating Records. No operating records exist for this dam.

d. Post Construction Changes. Based on information contained in the DER correspondence file, it appears as though the downstream masonry face of the dam was refaced sometime between 1935 and 1948. More recent modifications include the repair or reconstruction of concrete approach and spillway retaining walls.

The original design for the dam included the construction of a roadway traffic bridge across the spillway crest. Past inspection reports indicate that the bridge was removed during 1948. The existing foot bridge which spans the crest was constructed since 1948, but no date is associated with the construction period.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses have been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. Since no signs of instability were noted during the inspection, the Lake Ondawa Dam is assumed to be safe for earthquake loading.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appeared to be in fair condition and adequately maintained. No seepage was observed during the inspection, although past inspection reports show a history of seepage especially around the 6 inch blow-off pipe. The concrete paving on the spillway crest appeared to be in fair condition and adequately maintained. No major deterioration of the concrete was observed. It was noted that the approach wingwalls and control section channel walls had recently been repaired or reconstructed. The concrete for the approach and retaining walls appeared to be in good condition.

The downstream face of the dam (spillway overflow section) appeared to be in fair condition. The near vertical masonry wall did not show any signs of extreme erosion. A small erosion area was noted to the right of the overflow section.

The visual observations, review of available data, hydrologic and hydraulic calculations and past operational performance indicate that the Lake Ondawa Dam and Reservoir is capable of controlling less than 10% of the PMF. The spillway is termed seriously inadequate. The dam is classified as an unsafe, non-emergency structure.

b. Adequacy of Information. Sufficient information is available to complete a Phase I Report.

c. Urgency. The recommendations suggested below should be implemented as soon as possible.

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required by a professional engineer knowledgeable in dam design and analysis.

7.2 Recommendations/Remedial Measures.

1. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction to increase the spillway capacity.

2. It should be ascertained whether the upstream flip valve on the 6 inch cast iron pipe drainline is capable of operation. If the flip gate is operable, it should be operated on a regular basis to insure it functions for its intended use. If the upstream flip gate is not operable, it should be made operable or other provisions should be made for upstream closure of the pipe through the embankment.

3. The erosion observed along the right edge of the downstream face of the vertical masonry wall should be repaired as soon as possible.

4. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

5. A regularly scheduled operations and maintenance program should be prepared and implemented to insure the continued safe operation of the structure.

6. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel. Particular attention should be paid to the condition of the masonry and its ability to support the earth embankment and any seepage that may develop.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Lake Ondawa Dam COUNTY Bradford STATE Pennsylvania ID# 517

TYPE OF DAM Earthfill HAZARD CATEGORY High

DATE(s) INSPECTION October 22, 1980
January 15, 1981 WEATHER Clear and cold · TEMPERATURE 35°

POOL ELEVATION AT TIME OF INSPECTION 1567.7 M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

Mr. Thomas Calkins, Sr. - Tim Leonard Rod & Gun Club

Mr. Theordore W. Calkins, Jr. - Tim Leonard Rod & Gun Club

O.T. McConnell
RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion observed along the right edge of the downstream face of the vertical masonry wall [spillway overflow section].	Should be repaired.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Appears to be all right.	
RIPRAP FAILURES	None.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Not excessive.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	An erosion area was observed along the right edge of the downstream face of the dam [spillway overflow section].	The erosion should be repaired.
ANY NOTICEABLE SEEPAGE	None.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	Not observed. Flip gate control on intake. See Appendix E.	If the gate is not operable it should be repaired or some other means should be developed to provide
OUTLET STRUCTURE	Not applicable.	upstream closure for the drain-line 6 inch drainline outlets on the downstream face of the dam.
OUTLET CHANNEL	Unobstructed.	
EMERGENCY GATE	6" flip gate.	The gate has not been operated in the recent past.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete appears to be in fair condition. No excessive deterioration of the channel was observed.	
APPROACH CHANNEL	Unrestricted.	
DISCHARGE CHANNEL	Minor amounts of brush and debris in the discharge channel.	
BRIDGE AND PIERS	A small foot bridge spans the spillway crest.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

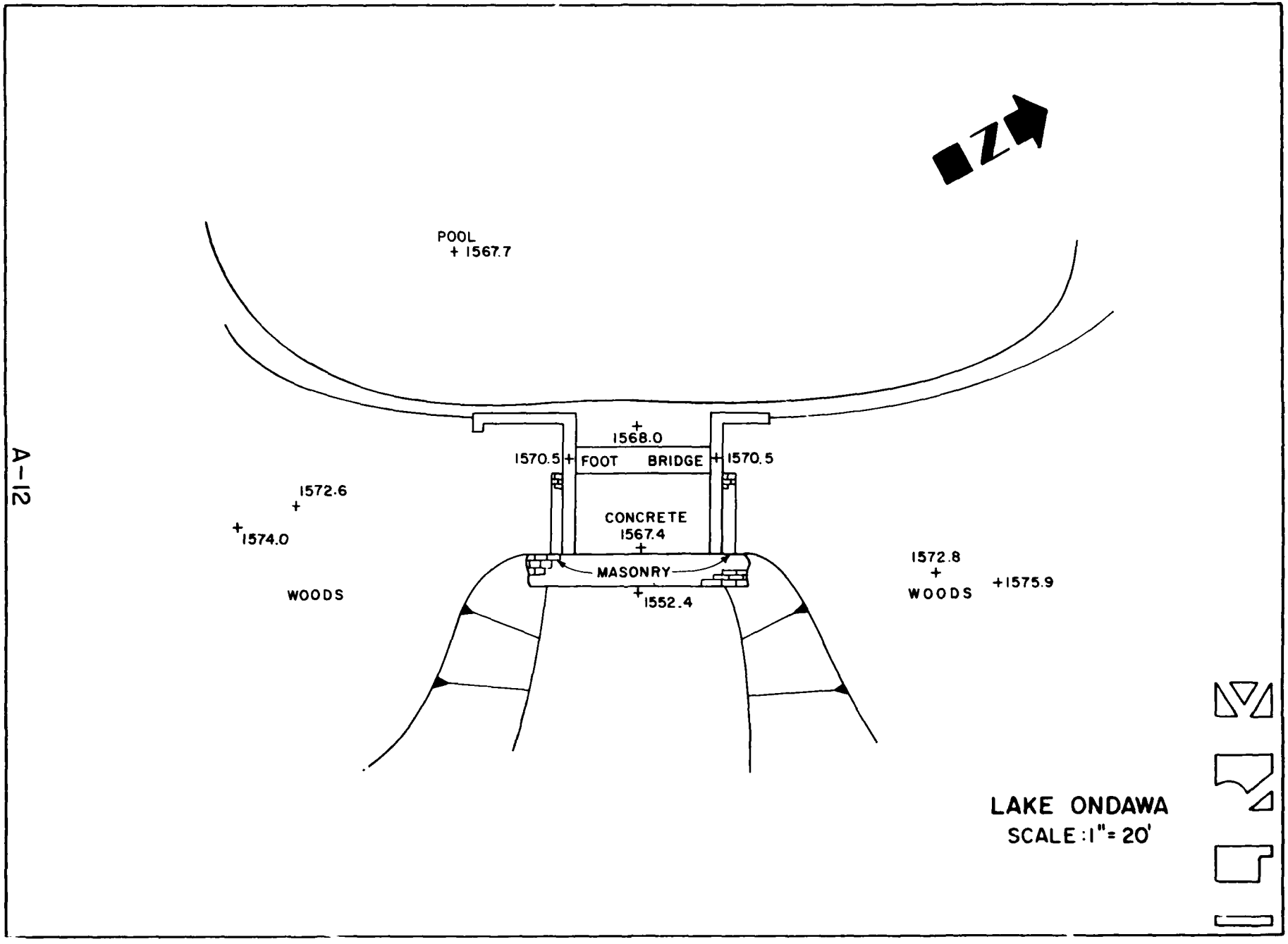
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The spillway discharge channel for the Lake Ondawa Dam consists of Bentley Creek. The channel is relatively steep and no major obstructions consists which would inhibit discharges through the channel.	
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Several homes are located at the outlet of Bentley Creek at the Village of Big Pond. The population of the affected homes is estimated at 10 people. The homes are located approximately 0.3 mile downstream of the dam.	A downstream warning system is recommended.

RESERVOIR

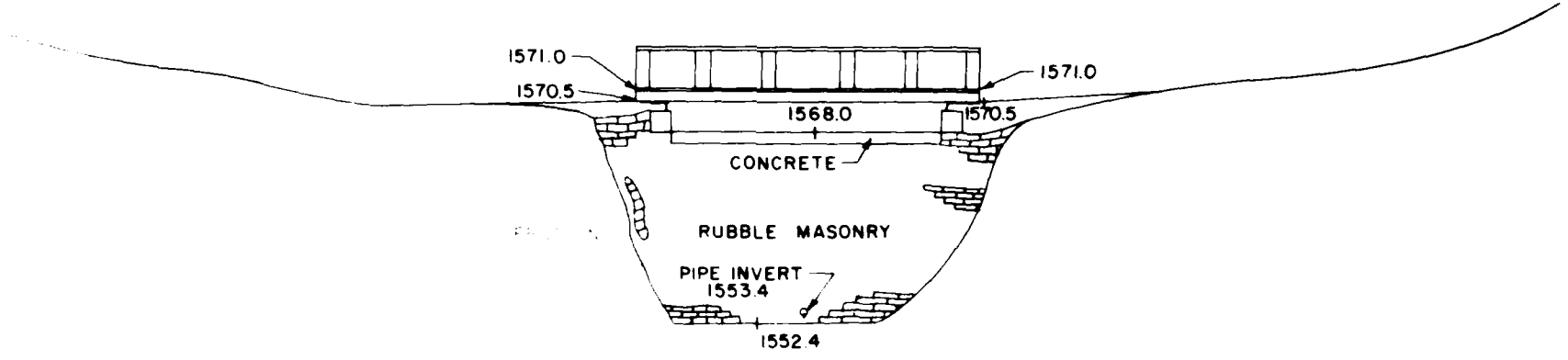
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate to steep but appear to be stable.	
SEDIMENTATION	Unknown.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	


N
POOL
+ 1567.7
+
1568.0
1570.5 + FOOT BRIDGE + 1570.5
1572.6
+
+ 1574.0
CONCRETE
1567.4
+
MASONRY
WOODS
+
1552.4
1572.8
+
WOODS
+1575.9
LAKE ONDAWA
SCALE : 1" = 20'

A-12



PROFILE
LOOKING UPSTREAM
SCALE: 1"=13'

LAKE ONDAWA

A-13

APPENDIX B

CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM ~~Lake Ondawa Dam~~

ID# PA 517

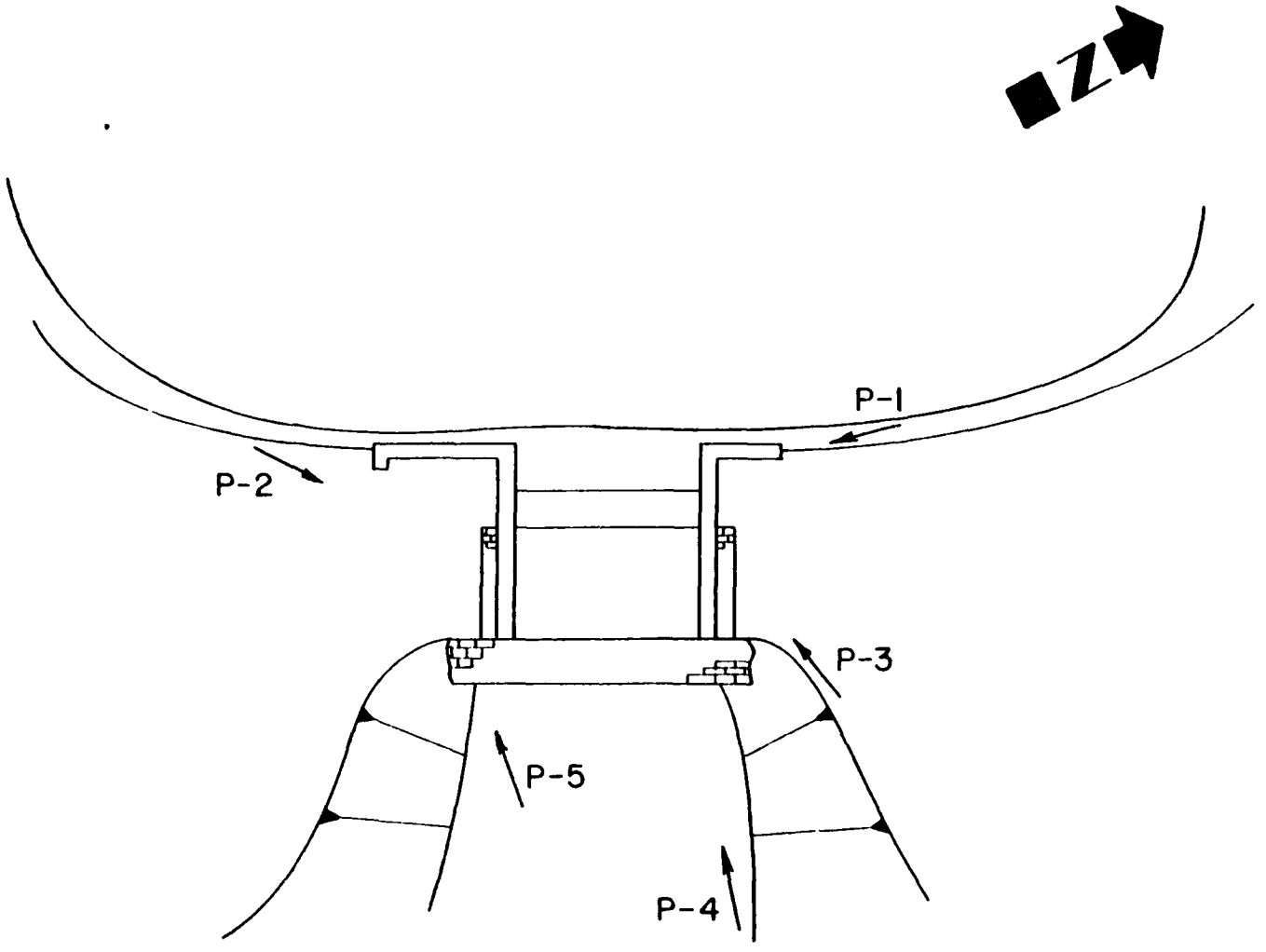
ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. 7.5 minute Bentey Creek quadrangle.
CONSTRUCTION HISTORY	Limited information available in the DER files.
TYPICAL SECTIONS OF DAM	See Appendix E.
OUTLETS - PLAN	See Appendix E.
- DETAILS	See Appendix E.
- CONSTRAINTS	See Appendix E.
- DISCHARGE RATINGS	None.
RAINFALL/RESERVOIR RECORDS	None.

ITEM	REMARKS
DESIGN REPORTS	Unknown.
GEOLOGY REPORTS	Unknown.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None. Limited information available in DER files. None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None.
POST-CONSTRUCTION SURVEYS OF DAM	None known to have occurred. Unknown.
BORROW SOURCES	

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	No major modifications are known to have occurred.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None known to exist.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Unknown.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	See Appendix E.
OPERATING EQUIPMENT PLANS & DETAILS	See Appendix E.

APPENDIX C
PHOTOGRAPHS



C-1

P- INDICATES PHOTO LOCATION

LAKE ONDAWA
PHOTO INDEX

LAKE ONDAWA DAM
PA 517

Sheet 1

Front

(1) Upper left - Spillway approach, upstream face of the embankment section and right abutment.
(2) Upper right - View of upstream face of embankment section and the left abutment area. Note the bridge which spans the spillway crest.

(3) Lower left - Spillway crest.
(4) Lower right - View of the downstream face of the spillway overflow.

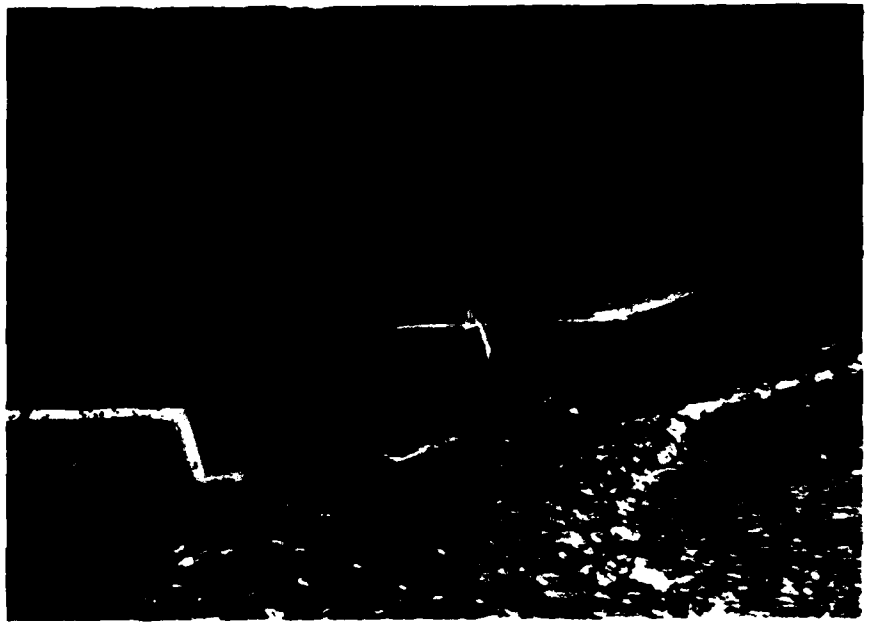
Back

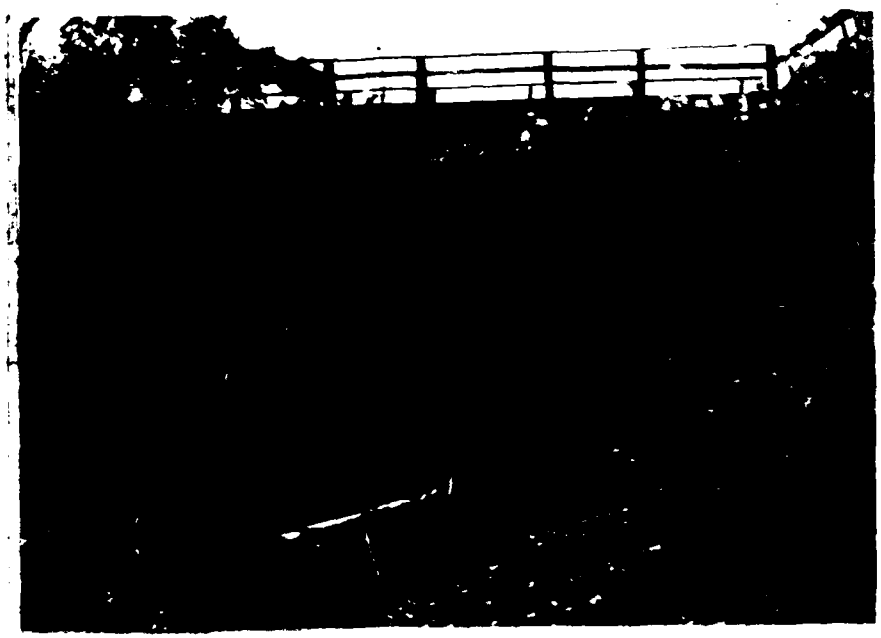
(5) Upper left - Right abutment of the spillway overflow. Note the erosion along the bank and the erosion at the contact of the masonry wall and the natural earthen embankment.

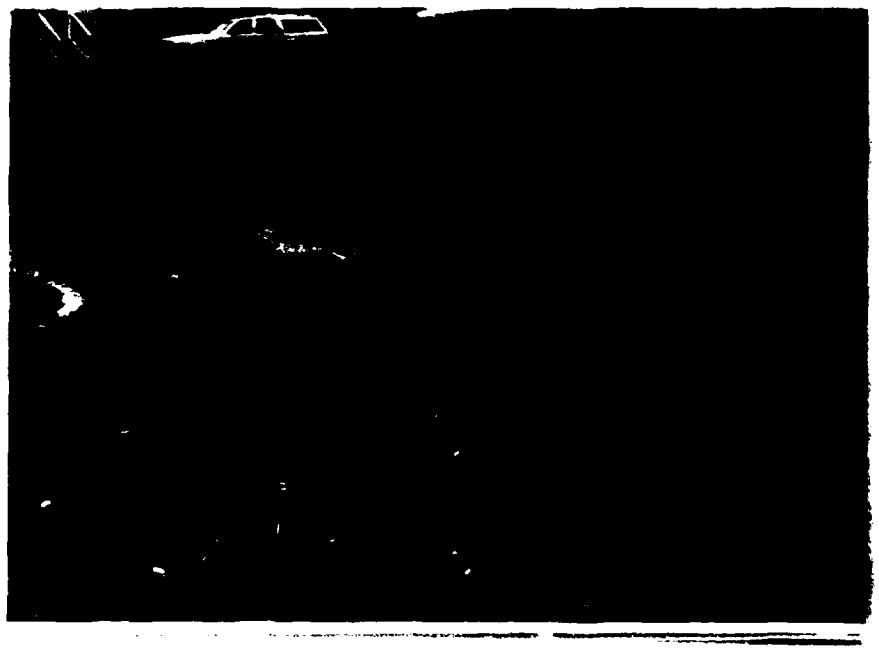
(6) Upper right - Downstream exposure.

TOP OF PAGE

1,5	2,6
3	4







APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 33" prepared by the U.S. Weather Bureau.

The index rainfall may be reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input, and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF, the computer program will calculate the percentage of the PMF, which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Lake Ondawa Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 (0.97) = 21.53 inches

STATION	1	2	3
Station Description	Lake Ondawa		
Drainage Area (square miles)	1.03		
Cumulative Drainage Area (square miles)	1.03		
Adjustment of PMF for Drainage Area (%)(1)			
6 hours	117		
12 hours	127		
24 hours	136		
48 hours	143		
72 hours	145		
Snyder Hydrograph Parameters			
Zone (2)	11		
Cp (3)	0.62		
Ct (3)	1.50		
L (miles) (4)	1.0		
Lca (miles) (4)	0.2		
tp = Ct(LxLca) 0.3 hrs.	0.93		
Spillway Data			
Crest Length (ft)	21.6		
Freeboard (ft)	2.5		
Discharge Coefficient	3.2		
Exponent	1.5		

(1) Hydrometeorological Report 40 (Figure 1), United States Weather Bureau and U.S. Army Corps of Engineers, 1965.
(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).
(3) Snyder's Coefficients.
(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.03 sq.mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1568 [153 ac-ft]

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1570.5 [215 ac-ft]

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1570.5 [low spot]

SPILLWAY CREST:

a. Elevation 1568.0
b. Type Broad crest
c. Width Crest length=21.6 feet
d. Length 23 feet
e. Location Spillover Mid-embankment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type One 6" diameter cast iron pipe with flip gate
b. Location Upstream slope
c. Entrance inverts Unknown
d. Exit inverts 1553.4
e. Emergency drawdown facilities 6" diameter CIP

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

NAME [illegible]
NUMBER [illegible]

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

SHEET NO ____ OF [illegible]
BY [illegible] DATE [illegible]

[illegible]

[illegible]

[illegible]

FROM [illegible]

[illegible]

$\therefore$ 20 = 3Y/23

$Y = \frac{20(23)}{3} = 153.3$ AC-FT

AT ELEV [illegible] AREA = [illegible] AC
AT ELEV. [illegible] AREA = [illegible] AC

TOP OF DAM [illegible]

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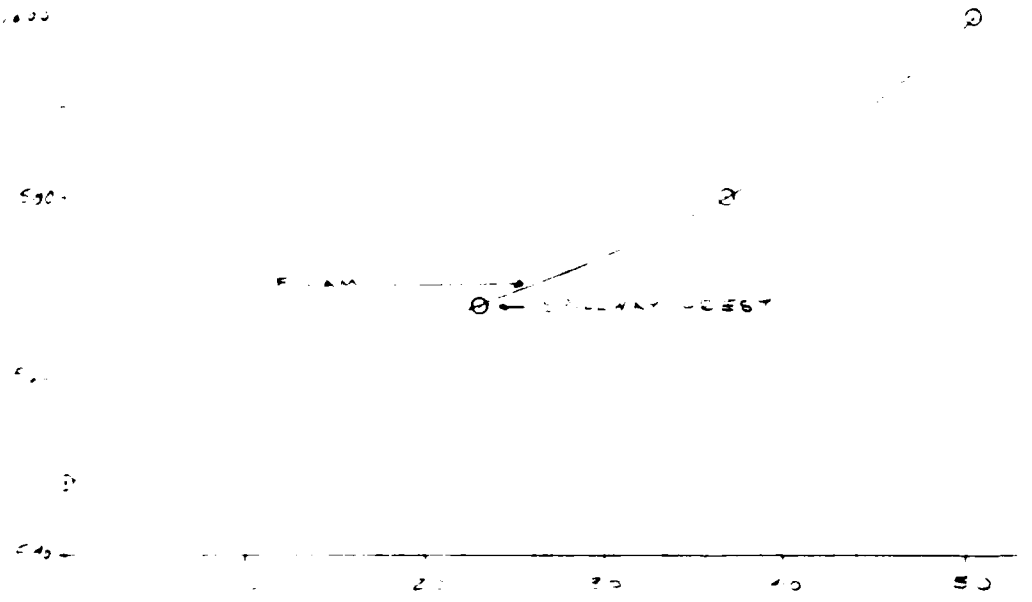
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-517
SHEET NO 2 OF 5
BY DTM DATE 3/81



					50.5
ELEV	548	568	570.5	580	600

USE C = 3.0 (BROAD CREST) if L = 2.6'

570.5

2.5

568

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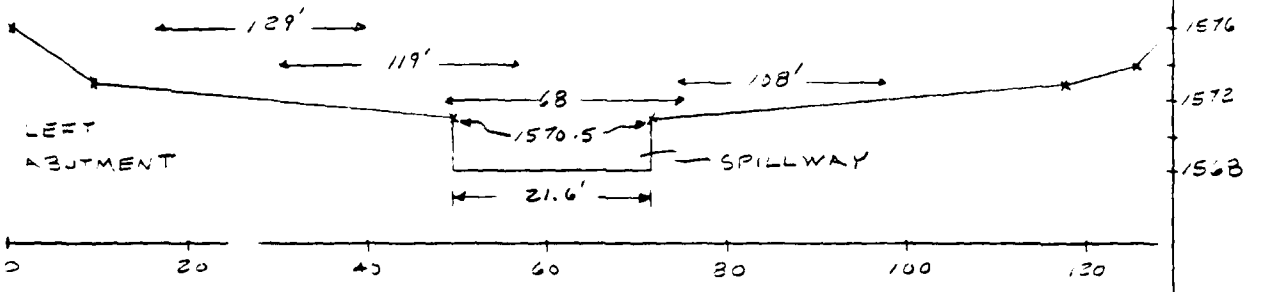
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME
NUMBER FL-517
SHEET NO. 3 OF 5
BY DTM DATE 3/81



TOP OF DAM PROFILE
VIEWING DOWNSTREAM

RATING CURVE INCLUDES OVERTOPPING.

ELEV. (Ft.)	SPILLWAY			OVERTOP			DISCHARGE *Q (cfs)
	h_1 (Ft)	$-_1$ (Ft)	Q (cfs)	h_2 (Ft)	$-_2$ (Ft)	Q_2 (cfs)	
1568	0	21.6	0				0
1569	1	"	65				65
1570	2	"	185				185
1570.5	2.5	"	255				255
1572				1.5	68	310	565
1573				2.5	108	1070	1,325
1574				3.5	119	1750	2,205
1576				5.5	129	4160	4,415

* Q ROUNDED TO NEAREST 5 cfs.

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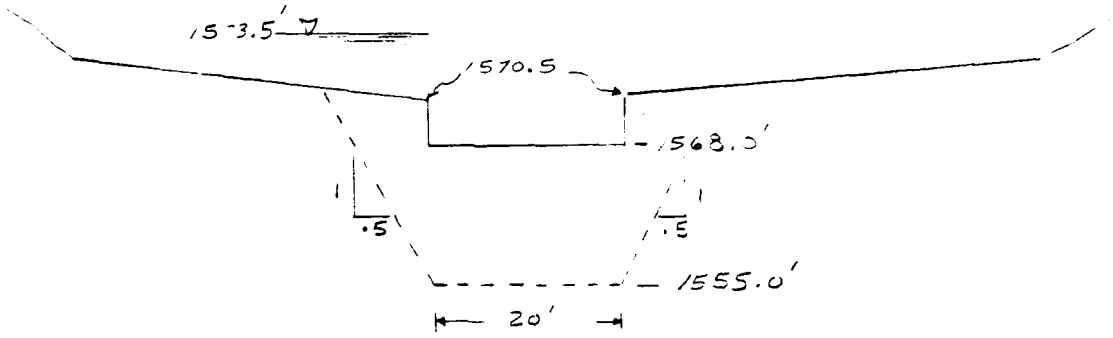
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-517
SHEET NO. 4 OF 5
BY OTM DATE 3/81

BREACH ANALYSIS

THE PMF ANALYSIS INDICATES THE DAM IS OVERTOPPED BY 3.45 FEET DURING THE 1/2 PMF. THE DEPTH OF OVERTOPPING AND DURATION IS CONSIDERED SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.

FROM FIG. ON PAGE 3 OF 5



BRWID = 20'
Z = 0.5
ELBM = 1555.0
TFAIL = 2 HRS
WSEL = 1568.0
FAILEL = 1573.5

0.5 PMF UTILIZED FOR BREACH ANALYSIS.

NOTE: BRWID & ELBM SELECTED BASED ON DATA CONTAINED IN DER. FILES (INSPECTION REPORT, DATED 7-5-29) WHICH DESCRIBED EXISTING BREACH CREATED BY THE OWNER IN AN ATTEMPT TO DRAIN THE RESERVOIR.

OTHER INFORMATION CONTAINED IN THE FILES INDICATED THE BOTTOM OF THE BREACH WAS ON BEDROCK.

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-517
SHEET NO. 5 OF 5
BY OTM DATE 3/81

REACH CROSS-SECTIONS BASED ON DATA OBTAINED FROM U.S.G.S. 7.5 MIN. QUAD.

OVERBANK MANNING'S n = 0.06 ASSUMED
STREAMBED MANNING'S n = 0.05 ASSUMED

NOTE:

THE VILLAGE OF BIG POND IS LOCATED AT THE OUTLET OF A NARROW CHANNEL (REACH 1) DOWNSTREAM OF THE DAM. THE VILLAGE LAYS AT THE EDGE OF A RELATIVELY WIDE FLOOD PLAIN (REACH 2).

REACH NO. 1 MODELS THE FLOW THROUGH THE NARROW DOWNSTREAM CHANNEL AND REACH NO. 2 WAS PROVIDED TO MODEL FLOWS THROUGH THE VILLAGE.

```
FLOO  HYDROGRAPH PACKAGE (HEC-1)
DAM   FETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
    1                A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
    2                A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF LAKE ONDAWA DAM
    3                A3       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA-517)
    4                B    288       0       15        0        0        0        0        0        0        0
    5                B1     5
    6                J      1       4        1
    7                J1   .05      .1       .5        1

    8                K      0       1                                          1
    9                K1       INFLOW
   10                M      1       1     1.03                       1                                    1
   11                P            21.53     117      127      136      143      145
   12                T                                                         1.0     0.05
   13                W    0.93    0.62
   14                X    -1.5     .05     2.0
   15                K      1       2                                          1
   16                K1       F    . THROUGH ONDAWA
   17                Y                                  1        1
   18                Y1                                                      -1568      -1
   19                Y4   156      1569     1570   1570.5     1572     1573     1574     1576
   20                Y5     0        65      185      255      565     1325     2205     4415
   21                $A     0        23       26     36.7     50.5
   22                $E  1548      1568   1570.5     1580     1600
   23                $$  1568
   24                $D1570.5
   25                K     99
```

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 01 APR 80
****

RUN DATE= 81/03/05.
TIME= 05.35.26.

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF LAKE ONDAWA DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA-517)

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1

RTIOS= .08 .10 .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.03	0.00	1.03	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.53	117.00	127.00	136.00	143.00	145.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= .93 CP= .62 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 4.27 AND R= 3.46 INTERVALS

UNIT HYDROGRAPH 21 END-OF-PERIOD ORDINATES, LAG= .93 HOURS, CP= .63 VOL= 1.00

54.	192.	348.	436.	403.	309.	231.	173.	129.	96.
72.	64.	40.	30.	23.	17.	13.	9.	7.	5.
4.									

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE THROUGH ONDAWA

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1568.	-1

STAGE	1568.00	1569.00	1570.00	1570.50	1572.00	1573.00	1574.00	1576.00
FLOW	0.00	65.00	185.00	255.00	565.00	1325.00	2205.00	4415.00
SURFACE AREA=	0.	23.	26.	37.	51.			
CAPACITY=	0.	153.	215.	511.	1379.			
ELEVATION=	1548.	1568.	1571.	1580.	1600.			

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1568.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1570.5	0.0	0.0	0.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .05	RATIO 2 .10	RATIO 3 .50	RATIO 4 1.00
HYDROGRAPH AT	1	1.03	1	242.	484.	2420.	4839.
	(	2.67)	(	6.85)(	13.70)(	68.51)(	137.03)(
ROUTED TO	2	1.03	1	123.	276.	2165.	4418.
	(	2.67)	(	3.47)(	7.80)(	61.30)(	125.09)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1568.00	1568.00	1570.50
STORAGE	153.	153.	215.
OUTFLOW	0.	0.	255.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	1569.48	0.00	189.	123.	0.00	42.25	0.00
.10	1570.60	.10	217.	276.	1.50	42.00	0.00
.50	1573.95	3.45	311.	2165.	7.75	41.00	0.00
1.00	1576.00	5.50	374.	4418.	10.00	40.75	0.00

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
```

```
     1              A1       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
     2              A2       DOWNSTREAM CONDITIONS DUE TO OVERTOPPING CLAPP ONDAWA
     3              A3       PLAN 1 ASSUMES BREACH. PLAN 2 ASSUMES NO BREACH  (PA-5177)
     4              R    28M        0       15        0        0        0        0        0        0        0
     5              B1     5
     6              J      2        1        1
     7              J1    .5
     8              K      0        1                                          1
     9              K1       INFLOW
    10              M      1        1    1.03                                  1                          1
    11              P              21.53      117      127      136      143      145
    12              T                                                          1.0     0.05
    13              W   0.93     0.62
    14              X   -1.5     -.05      2.0
    15              K      1        2                                          1
    16              K1       ROUTE THROUGH ONDAWA
    17              Y                                        1        1
    18              Y1     1                                                  -1568      -1
    19              Y4  1568     1569     1570   1570.5     1572     1573     1574     1576
    20              Y5     0       65      185      255      565     1325     2205     4415
    21              $A     0       23       26     36.7     50.5
    22              $E  1548     1568   1570.5     1580     1600
    23              $$  1568
    24              $D1570.5
    25              $B    20       .5     1555        2     1568   1573.5
    26              $B    20       .5     1555        2     1568     1580
    27              K      1        3                                          1
    28              K1       REACH 1
    29              Y                                        1        1
    30              Y1     1
    31              Y6   .06      .05      .06     1498     1540      900     0.06
    32              Y7     0     1540      200     1520      250     1500      252     1498      258     1498
    33              Y7   260     1500      275     1520      450     1540
    34              K      1        4                                          1
    35              K1       REACH 2
    36              Y                                        1        1
    37              Y1     1
    38              Y6   .06      .05      .06     1435     1500      700    0.085
    39              Y7     0     1500      300     1460      500     1440      650     1435      750     1435
    40              Y7   850     1440     1200     1460     1700     1480
    41              K     99
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********

RUN  DATE= 81/03/09.
     TIME= 12.17.35.
```

RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
DOWNSTREAM CONDITIONS DUE TO OVERTOPPING (LAKE ONDAWA)
PLAN 1 ASSUMES BREACH, PLAN 2 ASSUMES NO BREACH (PA-517)

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 2 NRTIO= 1 LRTIO= 1

RTIOS= .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.03	0.00	1.03	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.53	117.00	127.00	136.00	143.00	145.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= .93 CP= .62 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 4.27 AND R= 3.46 INTERVALS

UNIT HYDROGRAPH 21 END-OF-PERIOD ORDINATES, LAG= .93 HOURS, CP= .63 VOL= 1.00

54.	192.	348.	436.	403.	309.	231.	173.	129.	96.
72.	54.	40.	30.	23.	17.	13.	9.	7.	5.
4.									

HYDROGRAPH ROUTING

REACH 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	1498.0	1540.0	900.	.06000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1540.00 200.00 1520.00 250.00 1500.00 252.00 1498.00 258.00 1498.00
260.00 1500.00 275.00 1520.00 450.00 1540.00

STORAGE	0.00	.38	1.03	2.01	3.32	4.95	6.92	9.21	11.83
14.78	18.06	22.52	28.87	37.12	47.26	59.30	73.22	89.04	106.76
126.36									
OUTFLOW	0.00	177.33	729.08	1723.36	3248.33	5385.47	8211.37	11798.72	16217.00
.21532.92	27622.92	32644.33	41175.98	53183.52	69017.86	89113.10	113917.42	143873.33	179411.88
220951.35									
STAGE	1498.00	1500.21	1502.42	1504.63	1506.84	1509.05	1511.26	1513.47	1515.68
1517.89	1520.11	1522.32	1524.53	1526.74	1528.95	1531.16	1533.37	1535.58	1537.79
1540.00									
FLOW	0.00	177.33	729.08	1723.36	3248.33	5385.47	8211.37	11798.72	16217.00
221532.92	27622.92	32644.33	41175.98	53183.52	69017.86	89113.10	113917.42	143873.33	179411.88
220951.35									

REACH 2

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ALL FLOWS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	LSTR
0.0	0.000	0.00	1	1	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	KLNTH	SEL
.0600	.0500	.0600	1435.0	1500.0	700.	.08500

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1500.00 300.00 1460.00 500.00 1440.00 650.00 1435.50 750.00 1435.00
850.00 1440.00 1200.00 1460.00 1700.00 1480.00

STORAGE	0.00	10.20	29.19	53.80	83.59	118.54	158.67	203.97	254.67	
1311.44										
	374.31	443.30	518.41	599.62	685.27	772.38	860.90	950.83	1042.18	
1134.93										
OUTFLOW	0.00	9720.31	45597.40	112380.99	208442.94	335589.10	495820.30	691196.62	921594.55	1
192064.95										
	1506289.92	1866735.57	2275853.42	2736057.41	3293191.19	3910357.03	4578387.53	5296391.71	6063667.79	6
879658.27										
STAGE	1435.00	1438.42	1441.84	1445.26	1448.68	1452.11	1455.53	1458.95	1462.37	
1465.79										
	1469.21	1472.63	1476.05	1479.47	1482.89	1486.32	1489.74	1493.16	1496.58	
1500.00										
FLOW	0.00	9720.31	45597.40	112380.99	208442.94	335589.10	495820.30	691196.62	921594.55	1
192064.95										
	1506289.92	1866735.57	2275853.42	2736057.41	3293191.19	3910357.03	4578387.53	5296391.71	6063667.79	6
879658.27										

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO APPLIED TO FLOWS 1 .50
HYDROGRAPH AT	1	1.03	1	2420.
		(2.67)		(68.51)(
			2	2420.
				(68.51)(
ROUTED TO	2	1.03	1	3457.
		(2.67)		(97.88)(
			2	2165.
				(61.30)(
ROUTED TO	3	1.03	1	3443.
		(2.67)		(97.51)(
			2	2170.
				(61.45)(
ROUTED TO	4	1.03	1	3427.
		(2.67)		(97.04)(
			2	2171.
				(61.49)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1568.00	1568.00	1570.50
STORAGE	153.	153.	215.
OUTFLOW	0.	0.	255.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1573.88	3.38	308.	3457.	4.33	42.50	40.50

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1568.00	1568.00	1570.50
STORAGE	153.	153.	215.
OUTFLOW	0.	0.	255.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1573.95	3.45	311.	2165.	7.75	41.00	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	3443.	1507.0	42.50

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2170.	1505.3	41.00

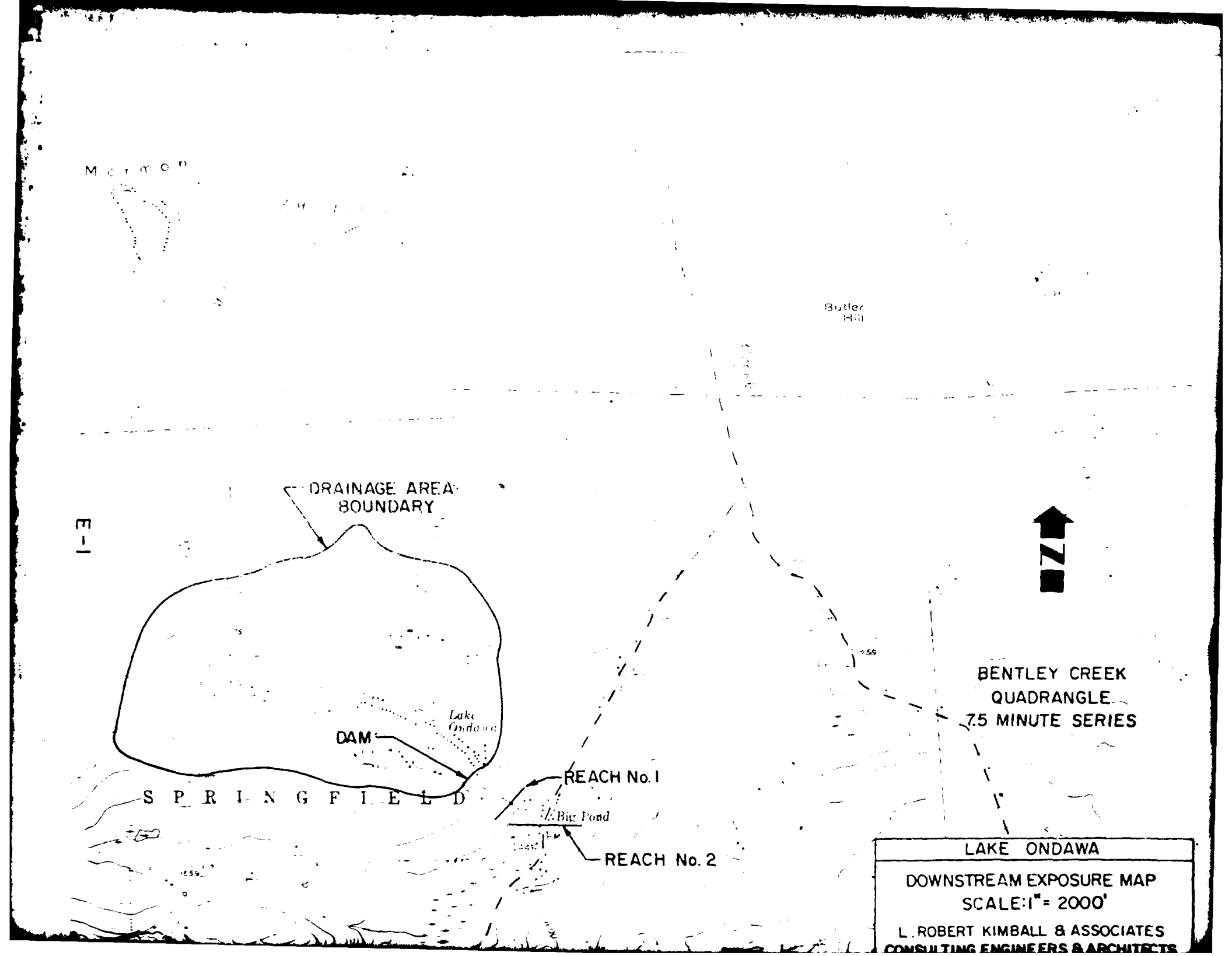
PLAN 1 STATION 4

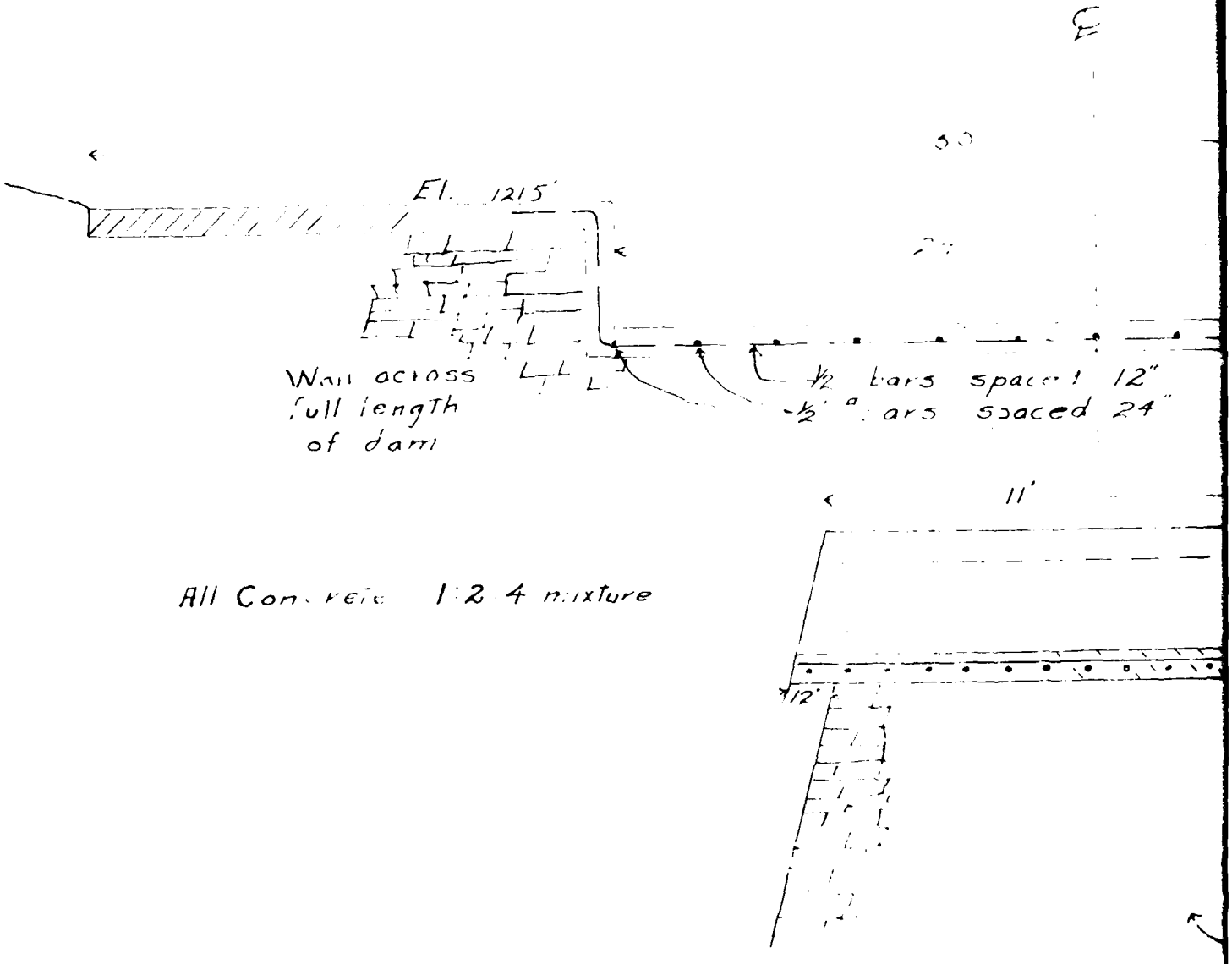
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	3427.	1436.2	42.50

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2171.	1435.8	41.00

APPENDIX E
DRAWINGS

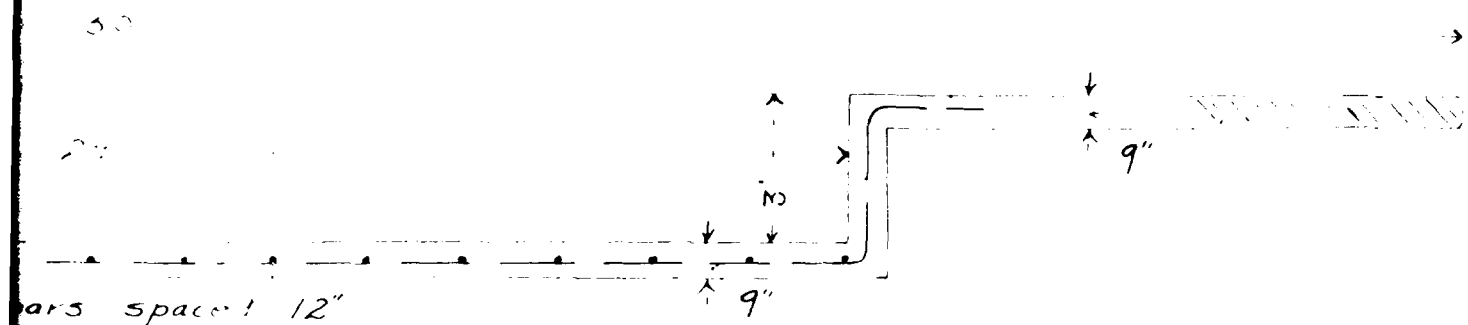

Mormon
Butler Hill
DRAINAGE AREA BOUNDARY
E-1
DAM
Lake Ondawa
SPRINGFIELD
REACH No. 1
Big Pond
REACH No. 2
BENTLEY CREEK QUADRANGLE 7.5 MINUTE SERIES
LAKE ONDAWA
DOWNSTREAM EXPOSURE MAP
SCALE: 1" = 2000'
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



All Concrete 1:2:4 mixture

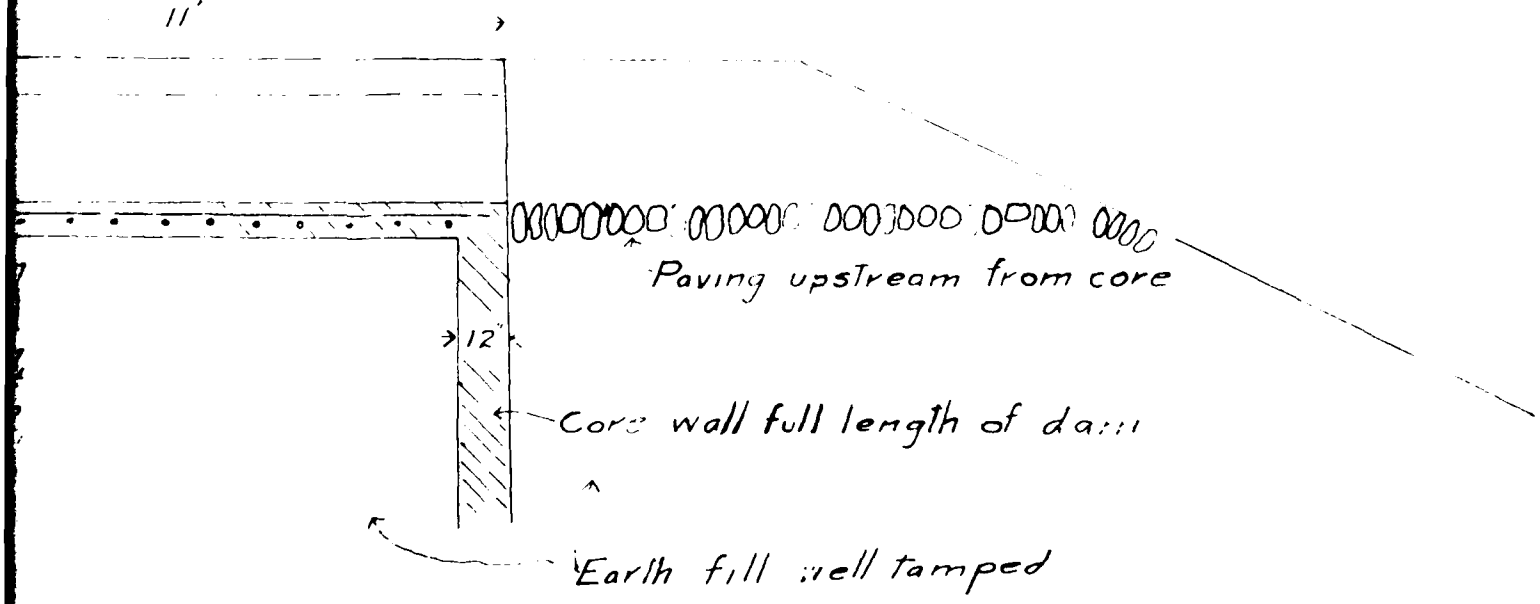
Section on ℄

Scale 1" = 3'



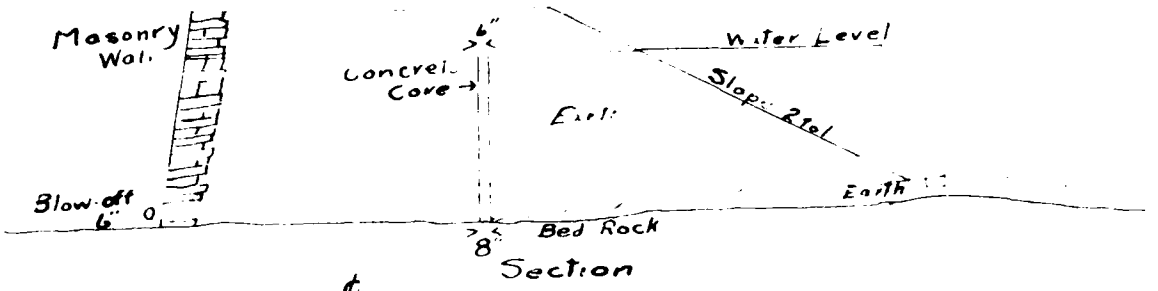
ars spaced 12"
ars spaced 24"

Detail of Spillway

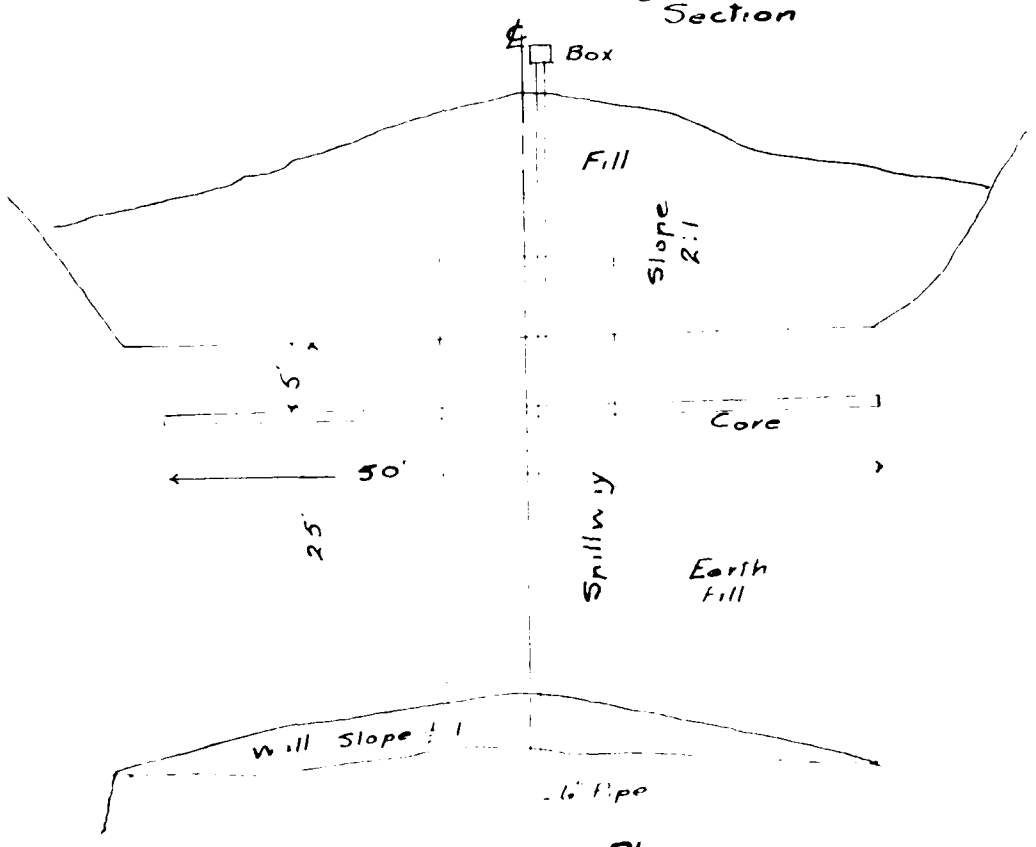


ion on ℄
ale 1" = 3'

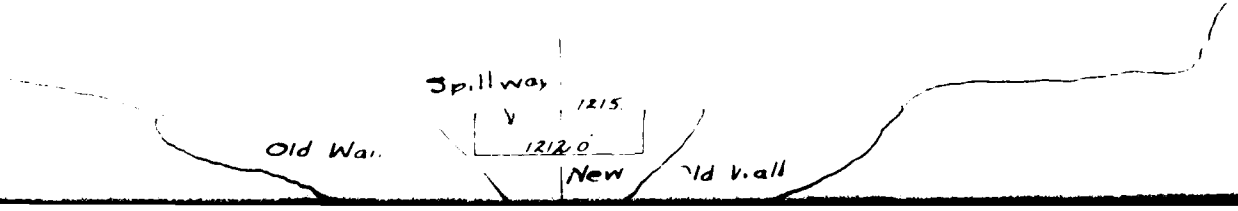
2

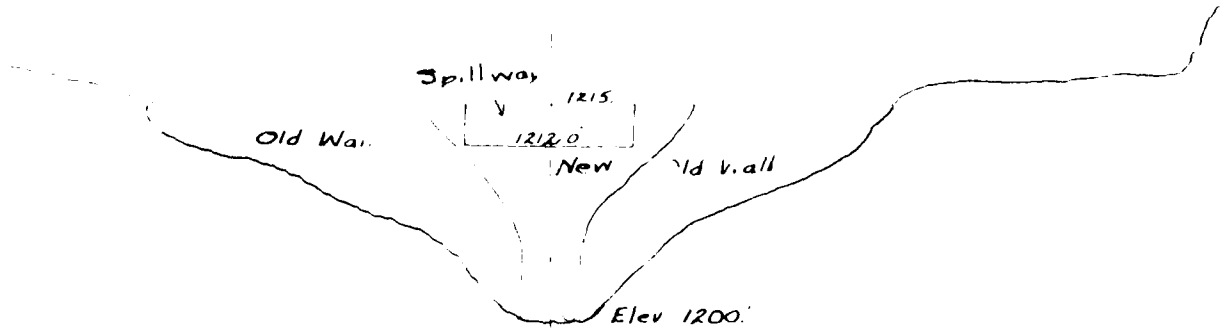


Section



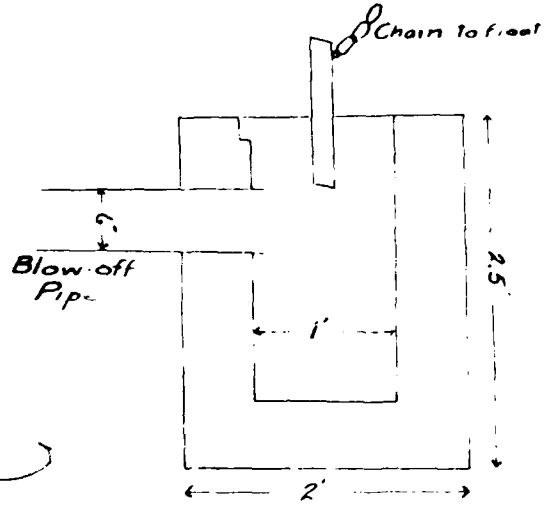
Plan





Elevation showing Wall

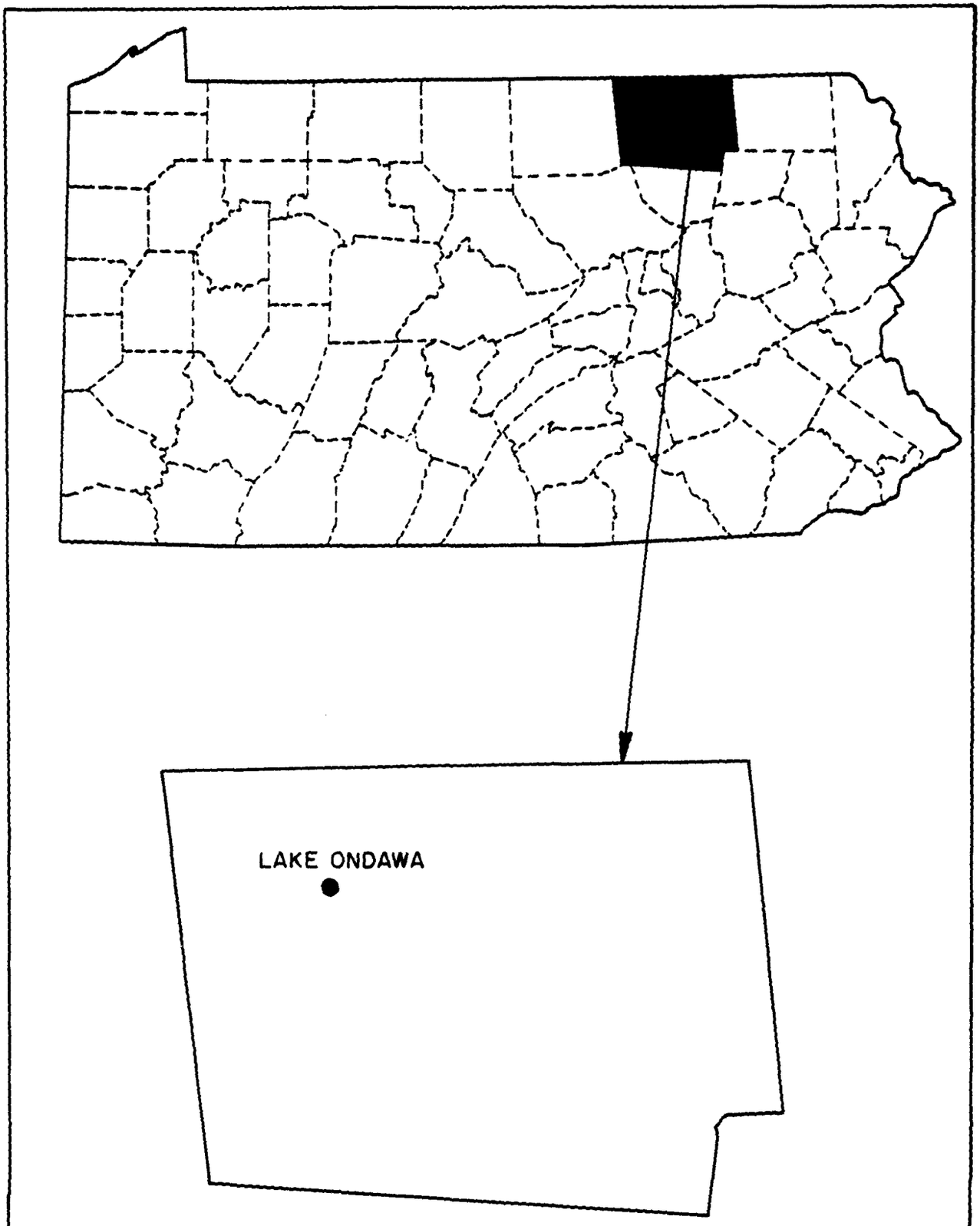
Section Stream Bed
50' below Dam



Detail of Gate
Section thru Blow-off

PROPOSED DAM
for
Tim Leonard Rod and Gun Club
Big Pond – Springfield Twp. – Bradford Co.
Area flooded 25 Acres
Watershed 2 Sq Miles
13 Mi[illegible] Chemung River
Scale 1"=10'
Chas. Leonard C.E.

E3



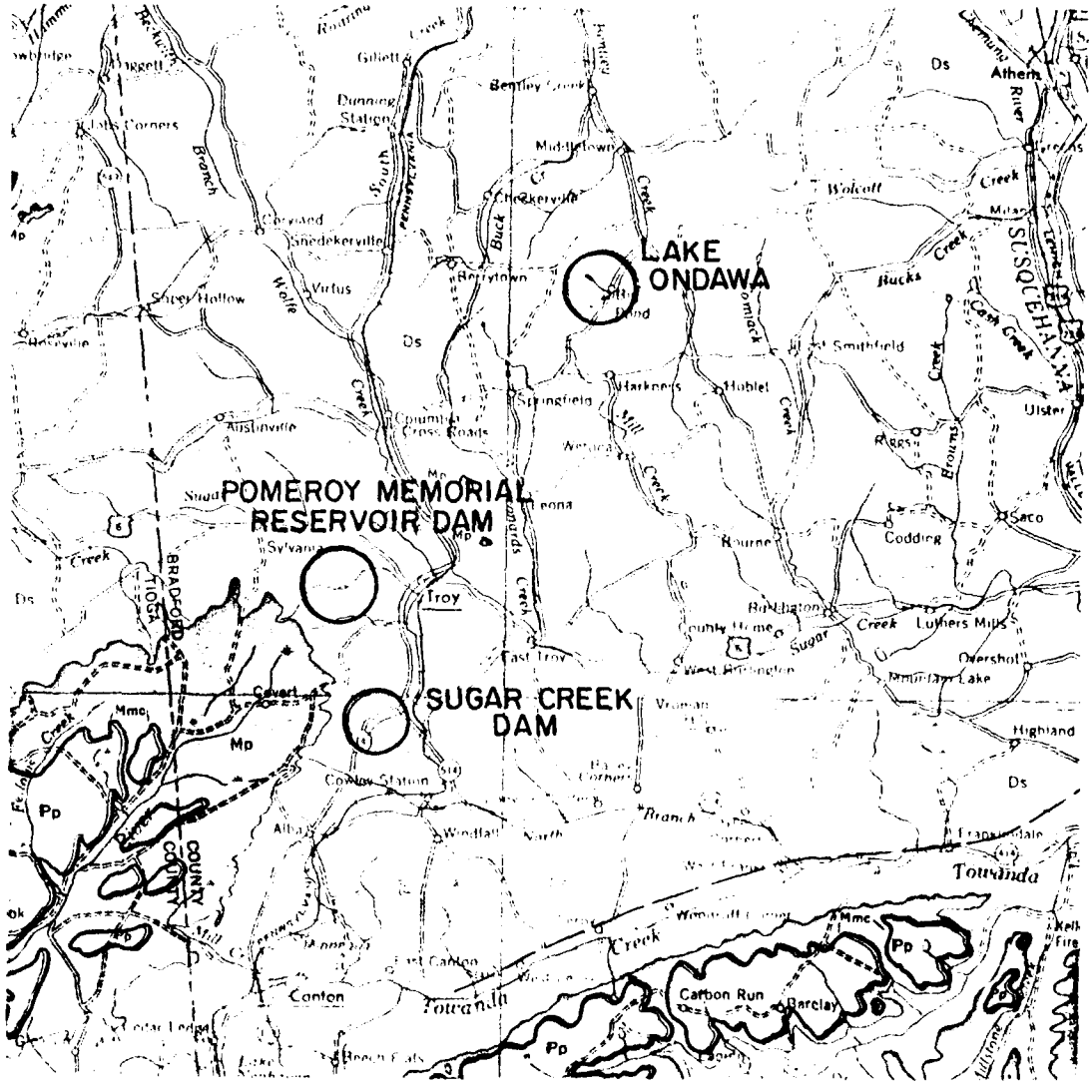
SITE LOCATION MAP
BRADFORD COUNTY, PENNSYLVANIA

APPENDIX F
GEOLOGY

General Geology

The Lake Ondawa Dam is located in the (Glaciated) Low Plateaus of the Appalachian Plateaus Province. Topographically, the area is deeply dissected leaving only remnants of the plateau surface. It was once covered by the Wisconsin glacier of Pleistocene time which left behind glacial drift or outwash. The glacial lake and stream deposits are the most productive water-bearing materials in the area. The bedrock underlying the dam consists of sandstones, shales, and graywackes of the Susquehanna Group of Upper Devonian Age. This group is divided into three formations, the Oswayo Formation (youngest), the Catskill Formation, and the Marine Beds (oldest) which include the "Chemung" and "Portage" beds. The Big Pond Dam lies on the Chemung side of the Catskill/Chemung contact.

These strata strike to the northeast and dip toward the southeast in the study area. This is due to the dam being located on the northwest limb of the Blossburg Syncline, which is the common flank of the Wellsboro Anticline. The geologic structure is typical of the Plateaus province, which has a series of well-defined folds trending northeast-southwest. There is no known faulting in this area.



GEOLOGIC MAP OF AREA AROUND POMEROY MEMORIAL RESERVOIR DAM, SUGAR CREEK DAM AND LAKE ONDAWA DAM

SCALE 1:250,000

DEVONIAN

UPPER

CENTRAL AND EASTERN PE LVANIA

Oswayo Formation

Resistant and greenish gray fine and medium grained sandstone with some shales and scattered concretions. Lower includes red shales which become more numerous eastward. Relation to type Oswayo not proved

Catskill Formation

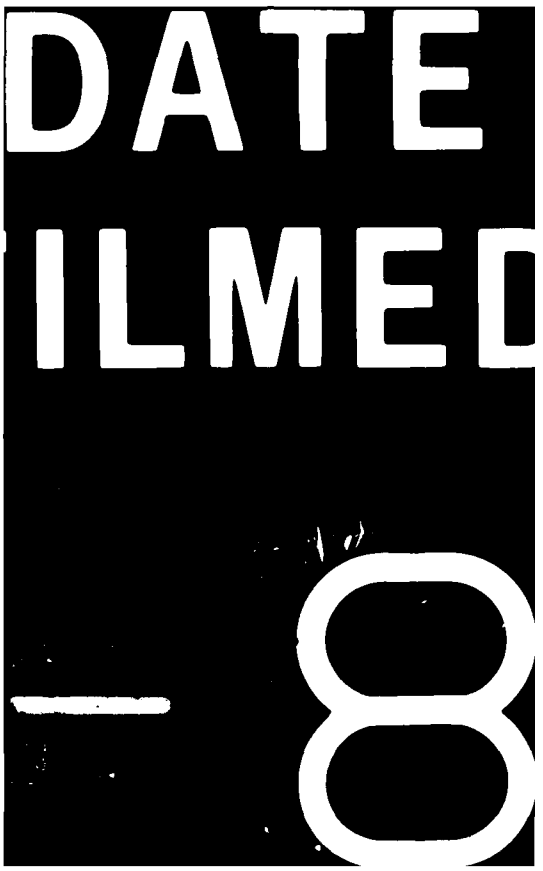
Chiefly red to brownish shales and sandstones with lenses of gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east

Marine beds

Gray to olive brown shales, greenstones and sandstones, southern "Chemung" beds and Portage beds including Rocket, Brallier, Harrell and Trimmers Rock. Tully Limestone at base

Susquehanna Group

Barbed line in "Chemung-Catskill" contact of Second Pennsylvania Survey County reports, barbs on "Chemung" side of line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8